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A Comparative Study of Laparoscopic vs Open Repair of Gastrointestinal Perforation

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Abstract: ***Gastrointestinal perforation is a surgical emergency associated with significant morbidity and mortality. This study compared laparoscopic and open repair of gastrointestinal perforations. Methods: A prospective comparative study was conducted on 36 patients, with 18 patients undergoing laparoscopic repair and 18 undergoing open repair. Outcomes assessed included operative time, blood loss, postoperative complications, surgical site infection, analgesic requirement, drain removal, resumption of daily activities, and hospital stay. Results: Laparoscopic repair was associated with significantly lower intraoperative blood loss, reduced analgesic requirement, earlier drain removal, lower surgical site infection rates, earlier return to daily activities, and shorter hospital stay. Operative time was comparable between groups. Postoperative leak rates were similar. Conclusion: Laparoscopic repair is a safe and effective alternative to open repair in selected patients with gastrointestinal perforation and offers improved postoperative recovery with fewer wound-related complications. Methods: A prospective comparative study was conducted on 36 patients, with 18 patients undergoing laparoscopic repair and 18 undergoing open repairs. Outcomes assessed included operative time, blood loss, postoperative complications, surgical site infection, analgesic requirement, drain removal, resumption of daily activities, and hospital stay. Results: Laparoscopic repair was associated with significantly lower intraoperative blood loss, reduced analgesic requirement, earlier drain removal, lower surgical site infection rates, earlier return to daily activities, and shorter hospital stay. Operative time was comparable between groups. Postoperative leak rates were similar. Conclusion: Laparoscopic repair is a safe and effective alternative to open repair in selected patients with gastrointestinal perforation and offers improved postoperative recovery with fewer wound-related complications.***

Keywords: Gastrointestinal perforation, Laparoscopic repair, Open repair, Peritonitis, minimally invasive surgery, Surgical outcomes.

1. Introduction

- Gastrointestinal perforation is a common abdominal emergency treated by general surgeon. It's a common dictum that abdomen is a Pandora's box and gastrointestinal perforation is one similar condition to prove it.
- Perforation of a hollow viscus from a wide variety of causes comprise the major portion of emergency surgical admission and emergency operations.
- **Gastrointestinal Perforation is defined as** a loss of continuity of bowel wall causes of which may include overuse of NSAIDS, peptic ulcer disorder, infection, trauma, ischemia.
- Gastrointestinal perforation includes Gastric, duodenal, jejunal, ileal and colonic perforation.

2. Aims and Objective

To compare between laparoscopic repair and open repair for Gastrointestinal Perforation

- Intra operative complication
- OT time
- Postoperative complication
- Surgical site infection
- Reoperation

3. Materials & Methods

This is a comparative study of 36 patients with Gastrointestinal perforation repair with open and laparoscopic method at General surgery Department of Tertiary care hospital.

Study Design: Prospective Comparative Study

Study Setting: The study was conducted at General Surgery department of Tertiary care Hospital.

Study Period: The study was conducted for a period of 18 months

- Sampling size -36(18 in each group) Sample size calculated Considering mean hospital duration of group A(laparoscopic) is 8.31 +/- 0.789 and group B (open repair)10.13 +/- 2.56 from last 3 months data record of department of surgery teaching tertiary hospital.
- Power = 80%, Level of confidence= 95%
- n = 36 ,18 in each group
- Sampling method – Random sampling

All patients in the study were assigned serial numbers from 1-36, and allocation based on 1st patient came with perforation operate with open method, 2nd patient came with perforation operate by laparoscopic method this method continue till 36 patients.

Inclusion Criteria (All / any of the following)-
- Any patient having Gastrointestinal perforation with consent
- Age >14
- Any gastrointestinal perforation presenting within 48hrs of symptoms
- Hemodynamically stable

Exclusion Criteria (All / any of the following)-
- Any patient with Gastrointestinal perforation without consent
- Any patient requires Resection and anastomosis or any additional procedure during surgery.
- Any patient with Esophageal or hepatobiliary system perforation.
- Any patient with GI perforation present with shock and septicemia. (Delayed presentation)
- Patient is having any contraindication to General Anesthesia and contraindication to pneumoperitoneum.
- Any Laparoscopic perforation repair converted to open.

4. Observation and Results

1) Age and Gender

Age (years)	Lap	Open
15-25	2	2
26-35	7	8
36-45	7	6
46-55	2	2
Mean	36	35.3
S.D	8.54	8.15
	Lap	Open
Male	14	15
Female	4	3
Total	18	18

Gastrointestinal perforation is considered to disease of young and productive age. In present study more than two third of the patients (88%) were between age 26-45 years with only 12% above age of forty-six. Youngest patient is 18-year-old.

Most patients in both groups were male. There were only seven female patients three (8.33%) in open group and four (22.22%) in laparoscopy group.

Symptoms	LAP	Open	Percentage
Pain	18	18	100%
vomiting	13	11	66%
distension	6	7	36%
fever	6	4	27%
	Addiction		
	Lap	Open	
smoking	7	6	
alcohol	9	7	
both	5	3	

2) Symptoms and Addiction

Most common symptoms found in our study is abdominal pain which is seen in every patient followed by vomiting which is 2nd most common symptoms.

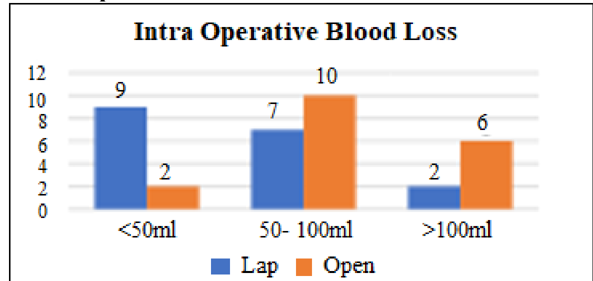
Personal habits like smoking and alcohol can cause gastrointestinal perforation. In this study 80% of patients having one or other Addiction

3) Site of perforation

		Site			
	Peptic	Ileal	Duodenal	Gastric	Colon
Lap	9	7	1	0	1
open	8	9	0	1	0

In present study, 47% of patients are of peptic perforation (50% lap, 44% open), 44% of ileal perforation (38% lap, 50% open), 2% of duodenal, gastric & colonic perforation.

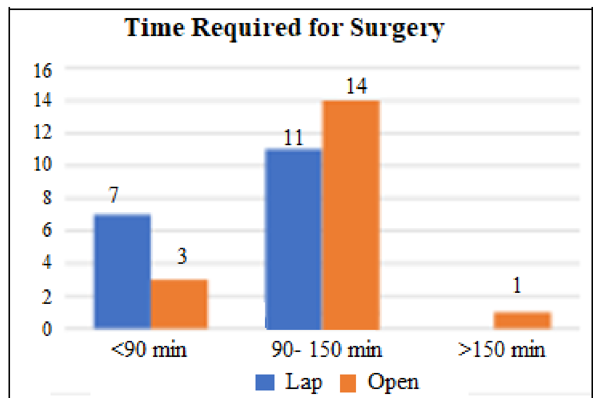
4) Intra Operative Blood Loss:



	<50 ml	50-100 ml	>100 ml	Mean	S.D.
Lap	9	7	2	61.66	28.74
Open	2	10	6	90.27	24.58

The p-value of 0.0029 indicates that there is statistically significant difference between laparoscopic and open surgery groups for intraoperative blood loss at the 95% confidence level. (p value <0.05)

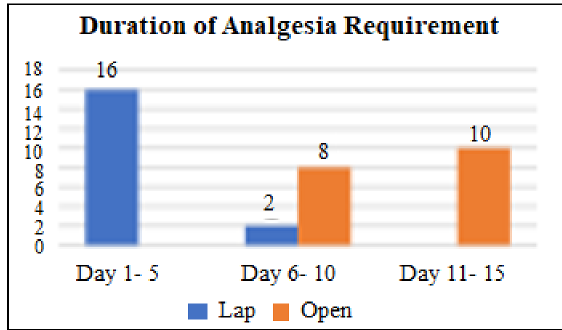
5) Time Required for Surgery:



	<90 min	90-150 min	>150 min	Mean	S.D
Lap	7	11	0	95.72	10.60
Open	3	14	1	105.11	16.89

The p-value of 0.054 indicates that there is no statistically significant difference between the mean surgery times of the laparoscopic and open surgery groups at the 0.05 significance level. However, it is very close to the threshold, suggesting a potential trend towards significance.

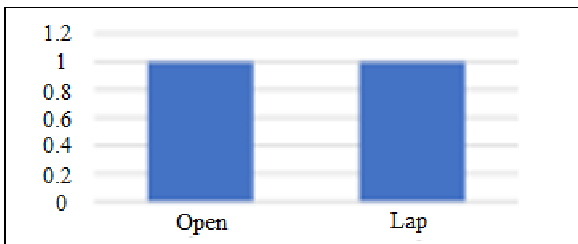
6) Duration of Analgesic Requirement



Duration of Analgesic Requirement			
	Day 1-5	Day 6-10	Day 11-15
Lap	16	2	0
Open	0	8	10

The p-value is very small (3.74×10−7), which indicates that there is a statistically significant difference in the duration of analgesic requirement between the laparoscopic and open surgery methods. This suggests that the choice of surgical method affects how long patients require analgesics postoperatively.

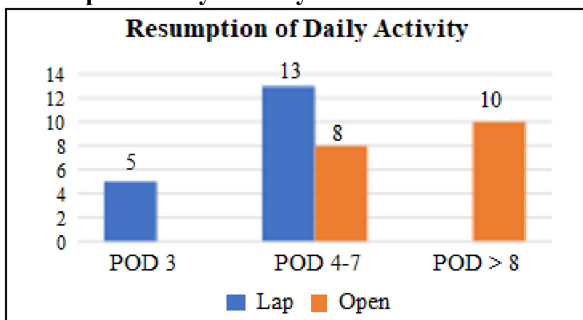
7) Postoperative leak:



	Postop Leak	Rate
Open	1	2.77%
Lap	1	2.77%

In both methods only one case of postoperative leak found so no any statistical significance of either method for postoperative leak.

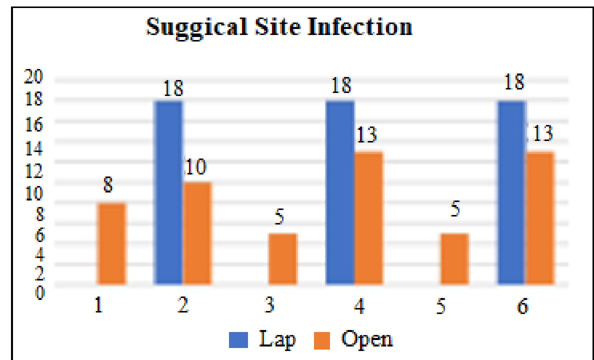
8) Resumption Daily Activity



	POD 3	POD 4-7	POD >8
Lap	5	13	0
Open	0	8	10

Approximately 0.00023 small p-value indicates a highly significant difference at 99% confidence level, suggesting that Laparoscopic method is significantly associated with the early to resume daily activities postoperatively than open method.

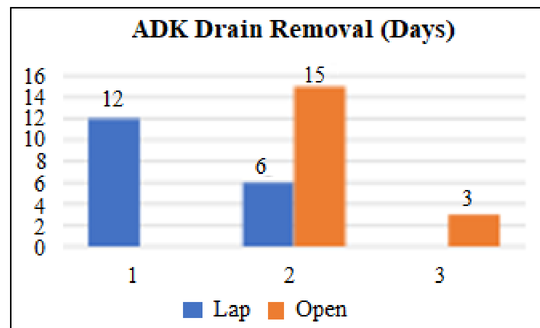
9) Surgical Site Infection:



	DAY3		DAY5		DAY15	
	Yes	No	Yes	No	yes	no
Lap	0	18	0	18	0	18
Open	8	10	5	13	5	13

small p-value (0.00044), difference is statistically highly significant at 95% confidence level suggest that the rate of surgical site infection was significantly lower in the laparoscopic group than in the open group.

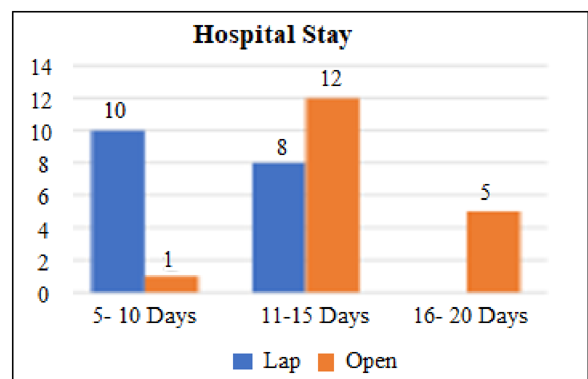
10) ADK Drain removal (Days)



	ADK Drain removal (Days)		
	POD 3-5	POD 6-8	POD >8
Lap	12	6	0
Open	0	15	3

In laparoscopic method ADK drain removal was much earlier than open method. Very small p-value (0.000012), difference is statistically highly significant at 95% confidence level for ADK drain removal

11) Hospital Stay



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	5-10 days	11-15 days	16-20 days	Mean	S.D.
Lap	10	8	0	9.88	2.02
Open	1	12	5	14.05	2.49

This very small p-value (1.26×10^{-7}) indicates a statistically significant at 99% confidence level difference between the two methods, with the open method associated with a longer hospital stay compared to the laparoscopic method.

5. Discussion

This prospective, comparative study was aimed at assessing the surgical outcomes of laparoscopic vs conventional gastrointestinal perforation. The patients admitted with any gastrointestinal perforation were randomized for laparoscopic (GROUP A) or conventional open method (GROUP B) on the odd-even basis. In both the method gastrointestinal perforation was repair by vicryl 2-0 with omentopexy. Then patient was assessed and compare for intraoperative and post-operative complication. The study assessed for intraoperative blood loss. Total 36 patients were enrolled for the purpose of this study, with equal distribution of 18-18 patients across both the groups. Gastrointestinal perforation is considered to disease of young and productive age and it varies with cause and geography but in case of perforation, there is tendency to shift towards older age especially in Western world to the extent that most of the patients with perforation are elderly in their 5th or 6th decade of life. But situation in third world countries has not changed much and most of the patients are still in the middle age group.

In present study more than two third of the patients (88%) were between age 26-45 years with only 12% above age of forty-six. Youngest patient is 18-year-old average age was 38. One study conducted in Dr. Kishan D Shah MS, et. al.[1] [Jamnagar] in which major patients of perforation were in age group of 41-60 years average age was 47. Overall, the age of sample in Dr. Kishan D Shah MS, et. al. [1] [Jamnagar] study was much older than our study sample.

This male preponderance with 80% this can be explained by addiction of alcohol and smoking were more commonly seen in males in this study.

In our study mean Intraoperative blood loss in laparoscopic group was 61.66 ±28.74 ml while for open method it was 90.27± 24.58 ml, Intraoperative blood loss is measured by dry gauze method. The p-value of 0.0029 indicates that there is statistically significant difference between laparoscopic and open surgery groups for intraoperative blood loss at the 95% confidence level.(p value <0.05) so blood loss is comparative lesser in laparoscopic method in our study 2 patient has >100ml blood loss which is due to port site bleeding and mesenteric vessel injury ,In *Deshmukh SN et al*[2] study mean blood loss for laparoscopic method it was 41while for open method it was 122.33 ml which was greater than our study

In our study, in both group majority of cases operative time was less than 150 min, mean operative time for laparoscopic group was 95.72± 10.60min and for open method it was 105.11± 16.89min. The p-value of 0.054 indicates that there is no statistically significant difference between the mean surgery times of the laparoscopic and open surgery groups at the 0.05 significance level. In Dr. Kishan D Shah MS, et. al.[1] Jamnagar study mean operative time for laparoscopic group was 112 min while in open method it was 92 min. while in study of Gabani N(2007)[3] mean operative time was 94 min and for open method it was 88 min, So in comparison to our study both study has lesser operative time for open method and for laparoscopic method operative time was lesser in our study in comparison to Jamnagar study while greater than Gabani N study(2007)[3].

Duration of analgesia require all patients in laparoscopic group require analgesia within 6 days postoperatively, mean days of analgesia require were 4 days , while in open method 55% patients require analgesia >11 days postoperative mean days of analgesia require were 10.5 days .The p-value is very small (3.74×10^{-7}), which indicates that there is a statistically significant difference in the duration of analgesic requirement between the laparoscopic and open surgery methods. This suggests that the choice of surgical method affects how long patients require analgesics postoperatively. In *Deshmukh SN et al*[2] study in lap group mean days of analgesia require were 2.60 days while in open method it was 4.1 days which was much lesser than our study in both groups.

Study	NO of Pt	Mean operative time (lap)	Mean operative time (open)
GABANI N, 2007[3]	50	94	88
Dr. Kishan D Shah MS, et. AI(JAMNAGAR) 2020[1]	50	112	92
PRESENT STUDY	36	95	105

For Resumption of daily activities in laparoscopic group all patients were resume their daily activities within 7 postoperative days while in open method 55% patients were resume their daily activities after 8 post operative days. Approximately 0.00023 small p-value indicates a highly significant difference at 99% confidence level, suggesting that Laparoscopic method is significantly associated with the early to resume daily activities postoperatively than open method. In *Deshmukh SN et al* [2]*-study* resumption of normal daily activities in open method was 33.07days and for laparoscopic method it was 13.33 days which significantly higher than out study.

STUDY	Blood Loss (ML) (LAP)	Blood Loss (ML) (open)	Resumption of Daily Activities (lap) Days	Resumption of Daily Activities (open) days	Duration of analgesia require (lap)days	Duration of analgesia require (open) days
Deshmukh SN, Parikh HP. 3	41	112.33	13.33	33.07	2.6	4.1
Singh j gill4	NA	NA	12	17	NA	Na
Ullah s 5	20	121.5	NA	NA	NA	NA
Siu, W. T., Leong, H. T6	NA	NA	10.4	26.1	2	6
Our study	61.66	90.27	4.66	10	4	10.5

With regards to Post op hospital stay, around >50% patients operated with Laparoscopic method (GROUP A) required <10 days of hospital stay as compared to the open method (GROUP B) where almost all the patients (95%) required >10-day of hospital stay only 1 patient require <10days of hospital stay. In Jamnagar study laparoscopic group mean postop hospital stay is 5 days and for open group is 8-9 days. Mean post-operative hospital stay was 9.88 ± 2 days in (Group A) laparoscopic group v/s 14 ± 2.49 days in open method (GROUP B). Correlation analysis through independent t test found statistically significant difference for length of hospital stay in perforation repair technique in laparoscopic group hospital stay is much lower than open group (p<0.001). While the mean duration of hospital stay was more in our study in both groups. In Singh J Gill[4] Jaipur study Hospital stay was significantly shorter in the laparoscopic group, 6.9 ± 2.2 versus 8.9 ± 3.3 days, this was also shorter in both group than our study.

6. Conclusion

- Laparoscopic repair of gastrointestinal perforations is linked to fewer complications, such as wound infections, sheath gaping, and wound dehiscence.
- Patients who underwent laparoscopic procedures had a significantly shorter hospital stay compared to those who had open repairs.
- There was no significant difference in the duration of surgery between laparoscopic and open repair for gastrointestinal perforations.
- Intraoperative blood loss was considerably lower in the laparoscopic group than in the open group.
- Postoperative pain was less after laparoscopic repair, leading to a reduced need for postoperative analgesics.
- Patients who underwent laparoscopic repair resumed daily activities much earlier and with greater ease compared to those who had open surgery.
- Laparoscopic repair of gastrointestinal perforations is a safe and effective treatment option, associated with fewer complications, even in patients who present later, as long as they are not vitally unstable.
- As surgeons gain more experience in laparoscopic techniques, the outcomes continue to improve, though the learning curve is flatter compared to open surgery.

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